DOCUMENT RESUME

ED 402 673 EA 028 137

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TITLE Epistemological Beliefs of Chilean Educators and School Reform Efforts.
PUB DATE Nov 96
NOTE 15p.; Paper presented at the Tercer Encuentro National de Enfoques Cognitivos Actuales en Educacion (Santiago, Chile, November 7-8, 1996).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Administrator Attitudes; Cognitive Development; Cultural Differences; *Educational Change; *Educational Philosophy; Elementary Secondary Education; *Epistemology; Foreign Countries; *Learning Strategies; School Restructuring; *Teacher Attitudes
IDENTIFIERS *Chile; *Missouri; Reform Efforts

ABSTRACT

Research increasingly supports the theory that individuals' epistemological beliefs--their fundamental views about knowledge and how it is acquired--influence academic learning, thinking, and problem solving. This paper presents preliminary findings of an ongoing study of educators from Chile and Missouri involved in research projects. A total of 126 teachers and principals from elementary and secondary schools in Santiago, Chile, completed Schommer's Epistemological Questionnaire (1989). Some of the teachers were involved in a school-reform project and some were not. In rural Missouri, 18 elementary and secondary teachers involved in a reform effort also completed the questionnaire. Findings indicate that Chilean teachers' and principals' beliefs did not differ significantly; nor did gender have an effect on Chilean teachers' responses. The epistemological scores of Chilean teachers involved in reform differed markedly from those of Missouri teachers. The scores of Chilean teachers not involved in reform also differed significantly from those of Missouri teachers. One explanation for the contradictory finding is that the questionnaire instrument is culturally biased. Finally, the epistemological beliefs of the Chilean teachers did not appear to change as a result of their year-long engagement in the school reform project. Two tables are included. (Contains 24 references.) (LMI)

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Epistemological Beliefs of Chilean Educators and School Reform Efforts

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Paper
presented at the
Tercer Encuentro National de Enfoques Cognitivos Actuales en Educacion
Pontificia Universidad Catolica de Chile
Santiago de Chile
November 7-8, 1996

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Epistemological Beliefs of Chilean Educators and School Reform Efforts

Abstract

Base-line data are presented from an on-going research project whose purpose is to examine relationships between educators' explicit epistemological beliefs and their implementation of teaching strategies specifically designed to apply certain principles from cognitive research on learning. The educators involved in this research are participating in reform projects in Chile and the United States. Results from quantitative analyses of the data suggest that although there are certain obvious cultural differences between Chilean and United States educators, investigation and identification of their epistemological beliefs may prove beneficial to the design of interventions that are likely to result in changes in their teaching and, consequently, the learning of their students. It is suggested that further data collection and modification of the instrument used in this study is needed to improve school reform efforts.

Epistemological Beliefs of Chilean Educators and School Reform Efforts

by

Daisy E. Arredondo & Terrance T. Rucinski

Introduction and Background

Increasingly, research evidence supports the theory that individuals' epistemological beliefs -- their fundamental views about knowledge and how it is acquired -- influence academic learning, thinking, and problem solving (Schommer, 1993; King & Kitchener, 1994; Kardash & Scholes, 1996). For example, in mathematics, researchers have found that individuals who believe that knowledge consists of isolated facts, have increased difficulty understanding mathematical concepts and procedures (Schoenfeld, 1985; Schommer, 1990; Schommer, Crouse, & Rhodes, 1992); similar findings have been reported between epistemological beliefs and the learning of scientific concepts (Songer & Linn, 1991; Spiro, Coulson, Feltovich, & Anderson, 1988). Other researchers acknowledge that teachers' epistemological beliefs may well influence how reform efforts are enacted in classroom practice (Greeno, 1989; Prawat, 1992). For example, a teacher with strong beliefs that knowledge is simple may decide that the most appropriate way to facilitate students' performance of authentic learning tasks is to subdivide such tasks into component skills that are taught and practiced in isolation. Such a strategy obviously subverts the intended purpose of authentic assessment.

Further, considerable research shows that the cognitive development of a variety of professionals are correlated with certain behaviors. For example, studies summarized by Reiman and Theis-Sprinthall (1993) show that for school principals, higher stages were predictive of more democratic behavior with teachers (Silver, 1975); and for teachers, higher stages were consistent with more effective teaching strategies, more empathy, more willingness to innovate (Miller, 1981), while lower stages were evident in teachers that tended to be more rigid in the classroom and less competent as supervisors of novice teachers (Theis-Sprinthall, 1984). Similarly, reviews

and meta-analyses of developmental research by Rest (1986) and Miller (1981) confirm that higher order stages of cognitive developmental reasoning are predictive of complex professional behavior. Based on these and other studies, Joyce and Showers (1995) argue that considerable support exists for the idea that the levels of cognitive development of teachers is related to their use of diverse teaching strategies and with their success in using certain innovations.

A line of research has been conducted by Schommer (1990, 1993) and others that views "epistemological beliefs" as a number of relatively independent continua of beliefs about the structure, source, and certainty of knowledge as well as the source of control and speed of knowledge acquisition. Responses to Schommer's 63-item questionnaire fairly consistently yield four factors reflecting these hypothesized dimensions. The questionnaire assesses the extent to which individuals believe that learning ability is innate, knowledge consists of isolated facts, learning is quick or not at all, and that knowledge is certain. From Schommer's perspective, individuals holding "sophisticated" views generally believe that knowledge is constantly evolving and thus uncertain, that some knowledge has yet to be discovered, and that relatively small amounts are considered unchanging (Kardash & Scholes, 1996). Schommer and others (Perry, 1968; Kitchener, 1983) have used the term "naive" to characterize individuals who believe that knowledge is certain, that it is acquired through external authority, and that it consists primarily of isolated bits of information; that the process of learning is quick or not at all; and that the ability to learn is fixed at birth (Kardash & Scholes, 1995). This "sophisticated" view of knowledge is also consistent with how King & Kitchener (1994) describe individuals exhibiting highly developed reflective judgment, and is quite similar to the higher levels of cognitive development described by Kegan (1994, 1982). Based on these and similar studies, it seems reasonable to expect that epistemological beliefs of teachers and principals may affect and/or predict behaviors of those involved in school reform efforts and hence affect the outcome of such reforms. Additionally, it seems likely that a potentially fruitful line of research for educators interested in school reform may well be the identification of interventions that are likely to result in changes in epistemological beliefs.

Research Questions

In this study, researchers interested in broad questions about the relationships between teachers' beliefs, classroom practices, and the development of student attitudes, behaviors, and beliefs about thinking and learning, are engaged in a long-term project to examine relationships between educators' explicit epistemological beliefs and their implementation of teaching strategies specifically designed to apply certain principles from cognitive research on learning. This paper reports baseline data on educators involved in reform projects in Chile and in the United States and describes preliminary results of researcher exploration of the following research questions: (1) What are Chilean teachers' and principals' epistemological beliefs? (2) Do Chilean teachers' epistemological beliefs differ from those of Chilean principals? (3) Do Chilean teachers' and principals' epistemological beliefs vary by gender and/or type of school? (4) What are the epistemological beliefs of a group of teachers engaged in a school reform effort in the United States? (5) How do the epistemological beliefs of this group of United States teachers differ from the beliefs of a group of Chilean teachers engaged in reform efforts? (6) Do the epistemological beliefs of Chilean teachers who volunteer to be involved in reform efforts differ from those who do not? And, (7) Do Chilean teachers' epistemological beliefs change as a result of staff development sessions designed to help them understand certain cognitive learning principles and to use teaching strategies based on those cognitive learning principles?

Research Methods

Participants in this part of the research study were 126 teachers and principals from elementary and secondary schools in Santiago, Chile, grouped as (1) teachers not involved in the school reform effort, (2) teachers involved in the reform effort, and (3) principals. In addition, preliminary data from a study of 18 elementary and secondary teachers involved with a school reform effort in a K-12 rural school in Missouri (USA) are reported. Baseline epistemological beliefs were assessed through use of a 63-item epistemological questionnaire, originally developed by Marlene Schommer (1989) for use with undergraduate college and high school students. Eight of the items were modified slightly so that questionnaire language was appropriate for adults.

These modifications were similar to changes that had been made by other researchers using the questionnaire with adults (Schommer, 1992). The modified questionnaire was translated into Spanish prior to its administration in Santiago. Researchers were careful to maintain the integrity of the items. The validity of the instrument was a concern; however, a preliminary judgment about the validity was made after administration of the questionnaire with a group of Chilean teachers. Following approximately one year of involvement in an intensive, three-year staff development project, the questionnaire was re-administered to the group of Chilean teachers involved in the reform project.

Because of the size of the samples, it was not appropriate to subject the data to a new factor analysis. Epistemological factor scores were therefore calculated using Schommer's previously determined factor structures. However, because preliminary data had suggested that Schommer's factor structures might be somewhat less stable among Chilean educators (for example, three of the factor structures appeared to be more closely matched across Chilean and United States cultures than did the fourth), comparisons have been made instead across mean scores on the 12 subsets of variables that comprise the four factor structures. Cross cultural differences were deemed likely, largely because previous studies by Pai (1990) have speculated that epistemological beliefs may be affected by family influences, especially among Hispanic-Americans on the items concerning "nature of learning". For example, in many American schools learning occurs through personal involvement and active communication, with individual achievement serving as an important motivational factor. Pai (1990) argues that many African-Americans, Asian-Americans, Hispanic-Americans, and Native-Americans believe that learning occurs as somewhat docile/ respectful students observe and emulate a role model, with the primary motivational factor being group achievement. Such values, nurtured within the family and social milieu, may well influence adult beliefs about the nature of knowledge and learning.

Results and Discussion

As data analysis proceeded, we became increasingly uncertain about the validity of using Schommer's existing factor structures for Chilean teacher and principal responses to the 63-items

on the epistemological questionnaire. Therefore, for the purposes of this paper, and while we continue to collect data for a new factor analysis, we have elected to report results about each of the twelve subset dimensions of those factor structures. What follows are those results, presented along with a discussion of the results as related to the seven research questions.

Epistemological beliefs of Chilean teachers and principals. Table 1 presents the twelve subset dimensions from the Schommer Epistemological Questionnaire, mean scores on each of those dimensions for Chilean principals, for teachers not involved in the reform project, and for teachers involved in the reform project. Examination of these data provide a clearer picture of Chilean teachers' and principals' epistemological beliefs.

Table 1 about here.

Epistemological scores range from 5 to 1, representing individual beliefs from relatively naive (5) to sophisticated (1). Of interest is the fact that mean scores are higher for the subset dimensions of "avoid ambiguity", "certainty of knowledge" and "seek single answers", which would tend to indicate less complex beliefs about knowledge. Lower mean scores were reported for "learn first time", "don't criticize authority", and "concentrated effort is a waste of time", indicating more sophisticated beliefs.

No significant differences were found to exist among the three groups of Chilean principals, teachers not involved in the reform project, and teachers involved in the project on the mean subset dimension scores, $p > .15$; however for two of the scores, "certainty of knowledge" and "depend on authority", the observed differences were significant at higher levels, i.e., $F(2, 123) = 2.501, p = .08$; and $F(2, 123) = 2.247, p = .11$. In addition, a comparison of the two teacher groups (those involved in the reform project and those not involved) showed no significant differences between the mean subset dimension scores, $p > .15$ for all variables except "certainty of knowledge", i.e., $F(1,95) = 2.404, p = .12$. These findings suggest that additional data

collection efforts may be worth pursuing. However, on the basis of these data and in response to our second and sixth research questions, we should conclude that Chilean teachers' and principals' epistemological beliefs do not differ significantly.

We were curious about whether Chilean teachers' and principals' epistemological beliefs varied by gender or by school type (research question three). No significant differences were found between mean epistemological scores for male and female Chilean teachers and principals, $p > .05$ on ten of the twelve subset dimensions. However, for two of the subset dimensions, "ability to learn is innate" and "learning is quick", the observed differences were significant at the $p > .10$ level, with $F(1,120) = 2.862, p > .09$, and $F(1,120) = 3.592, p > .06$ respectively. Significant differences among the mean epistemological belief scores of teachers from public, private and subsidized schools were found on one of the twelve subset dimensions, "depends on authority", $F(2,116) = 3.046, p > .05$. Interestingly, private school teachers exhibited the highest mean score of 3.25 (Std Dev = .61), public school teachers the second highest mean score of 2.92 (Std Dev = .59) and subsidized school teachers the lowest mean score of 2.76 (Std Dev = .58). All other mean subset dimension score differences were not significant, $p > .15$. Again these differences suggest that additional data collection may be worthwhile.

Epistemological beliefs of United States teachers. Research questions four and five asked about the epistemological beliefs of a group of teachers engaged in a school reform effort in a small rural school housing grades kindergarten through twelve in the United States, and about how these teachers' epistemological beliefs differed from the beliefs of Chilean teachers engaged in a school reform project. Table 2 presents the twelve subset dimensions from the Schommer Epistemological Questionnaire and mean scores on each of those dimensions for the sample of United States teachers engaged in a school reform project intended to help teachers develop understanding of newer cognitive research, and to help them develop skill in using teaching strategies based on principles from that research.

Table 2 about here.

Examination of these data reveal significant differences ($p > .05$) between United States and Chilean teachers' epistemological beliefs on several of the subset dimensions. For example, a comparison of the mean epistemological belief scores for Chilean school reform project teachers and United States reform project teachers reveal differences on five of the twelve subset dimensions: "avoid ambiguity", $F(1, 41) = 10.793, p > .002$; "concentrated effort is a waste of time", $F(1,41) = 4.008, p > .05$; "can't learn how to learn", $F(1,41) = 18.940, p > .0001$; "seek single answers", $F(1,41) = 19.796, p > .0001$; and "success is unrelated to hard work", $F(1,41) = 26.1484, p > .0000+$. Additionally, one other subset dimension, "knowledge is certain", has an $F(1,41) = 2.839, p > .09$. The remaining six, however, show nonsignificant differences, $p > .20$.

United States teachers' epistemological scores on the twelve subset dimensions were also compared to a sample of Chilean teachers' who were not involved in the school reform project in Santiago schools. Curiously, significant differences, $p > .05$, were also found for seven of the twelve subset dimensions. These were: "avoid ambiguity", $F(1,90) = 17.431, p > .0001$; "knowledge is certain", $F(1,90) = 12.657, p > 0006$; "don't criticize authority", $F(1,90) = 6.587, p > .01$; "can't learn how to learn", $F(1,90) = 25.836, p > .0000+$; "learning is quick", $F(1,90) = 4.625, p > .03$; "seek single answers", $F(1,90) = .0000+$; and "success is unrelated to hard work", $F(1,90) = 26.671, p > .0000+$.

From these data, it seems possible to posit at least two plausible explanations: First, Chilean teachers' epistemological scores differ markedly from those of teachers engaged in a similar school reform project in the United States. This would appear to be so even for those who do not choose to engage in a school reform project. Curiously however, if this is true, then we may ask how we might explain the seemingly unusual finding that more differences were observed between the non-project Chilean teachers and United States teachers, than were observed between the project Chilean teachers and the United States teachers. Secondly, and at this point, this

explanation seems more likely to us, Schommer's Epistemological Questionnaire may be inappropriate for assessment of Chilean teachers' epistemological beliefs, perhaps because of a cultural bias in the items.

Our final research question asked whether or not epistemological beliefs of Chilean teachers changed as a result of their year-long engagement in the school reform project. No significant differences, $p > .12$, were found between the mean scores of pre- and post-administrations of the Epistemological Questionnaire with the Chilean teachers engaged in this school reform effort. Since cognitive developmental change is a question of great interest to school reformers throughout the world, we were both anxious and curious about the results of the data analysis. From research reported by Reiman & Theis-Sprinthall (1993), we know that certain conditions must be present in order for interactions between teachers, their new learning or staff development experiences, and their colleagues or supervisors to result in adult development or psychological growth. Those conditions include a significant learning experience, reflection on that experience, balance between reflection and experience, support for and challenge to the new learning, and a continuous involvement over at least a five-month period of time. The extent to which these conditions have been met by this school reform project is unclear. In addition, the appropriateness of applying these conditions to judgments about Chilean reform efforts is unknown.

Implications

The study of teachers' epistemological beliefs is important because they directly impact the development of student beliefs about learning. For example, much is known about how students' epistemological beliefs influence their performance on a variety of learning tasks (Schommer, 1990; Schommer, Crouse, & Rhodes, 1992), however, much less is known about how student beliefs develop in the first place. Consider, for example, a teacher who purports to believe that artful instruction facilitates the development of active, independent student learners who recognize the changing nature of knowledge. If, this same teacher favors lecturing as an instructional strategy and measures learning with multiple choice exams that test isolated facts and allow for only one correct answer, then he or she risks sending students the implicit message that knowledge

is simple, certain, and handed down by authority. Obviously, the teaching of such beliefs to students flies in the face of many current school reform efforts. From the identification of relationships among teachers' beliefs and their learning about and use of teaching strategies believed to be consistent with cognitive research about student learning, we should be able to determine how teacher beliefs impact the development of student beliefs about learning. Further, should explicit teacher beliefs about learning and about knowledge be predictive of teacher implementation of newer teaching strategies, agents of school reform will have gained valuable policy information about requisite structure and direction for planning staff development efforts.

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Table 1

Epistemological beliefs of Chilean teachers and principals

	Principals[1]		Teachers NOT in project[2]		Teachers IN project[3]	
	Mean	SD	Mean	SD	Mean	SD
Can't learn how to learn	2.33	.39	2.33	.40	2.39	.46
Success is unrelated to hard work	2.45	.55	2.46	.57	2.50	.55
Learn first time	2.08	.58	2.10	.69	1.87	.61
Don't criticize authority	2.14	.37	2.16	.69	2.03	.45
Avoid ambiguity	3.43	.65	3.43	.55	3.31	.43
Avoid integration	2.14	.41	2.23	.40	2.12	.36
Seek single answers	3.25	.40	3.29	.35	3.20	.31
Depend on authority	3.04	.55	2.84	.56	2.71	.63
Learning is quick	2.16	.43	2.19	.52	2.02	.55
Concentrated effort is a waste of time	2.00	.61	2.20	.87	2.08	.72
Ability to learn is innate	2.83	.56	2.82	.67	2.74	.47
Knowledge is certain	3.41	.77	3.24	.55	3.03	.60

Note: 1. N = 29 2. N = 73 3. N = 24

Table 2

Epistemological beliefs of teachers in Pilot Grove (USA)

	Mean	SD
Can't learn how to learn	1.81	.39
Success is unrelated to hard work	1.74	.40
Learn first time	2.12	.70
Don't criticize authority	1.90	.41
Avoid ambiguity	2.85	.49
Avoid integration	2.07	.44
Seek single answers	2.75	.36
Depend on authority	2.91	.47
Learning is quick	1.91	.47
Concentrated effort is a waste of time	2.50	.62
Ability to learn is innate	2.57	.50
Knowledge is certain	2.74	.41

Note: N = 19